

2002 0379
IGSL

MENLO PARK
NOISE ELEMENT OF
THE COMPREHENSIVE PLAN

INSTITUTE OF GOVERNMENTAL
STUDIES LIBRARY

MAY 21 2002

UNIVERSITY OF CALIFORNIA

Prepared by

Charles M. Salter Associates Inc.
350 Pacific Avenue
San Francisco, California 94111

Prepared for

City of Menlo Park, California

SECTION 1 - THE NOISE ELEMENT OF A PLANNING PLAN

Executive Notice Letter and Cover for Comprehensive	11
Environmental Noise	24
The Noise Element's Contents and the Guidelines	31
Noise Guidelines	32
Noise Mitigation	33

MENLO PARK

NOISE ELEMENT OF

THE COMPREHENSIVE PLAN

APPENDICES

A - EXECUTIVE SUMMARY	34
B - COMPREHENSIVE NOISE GUIDELINES	35
C - NOISE MITIGATION	36

Adopted by Planning Commission

On October 16, 1978

Adopted By City Council

On November 14, 1978

REPORT
OF THE
COMMISSIONER OF THE
LAND OFFICE

Presented to the
Legislature of the State of New York

in answer to a
resolution of the Senate

SECTION V - THE NOISE ELEMENT AS A PLANNING TOOL 39

Exterior Noise Levels and Land Use Compatibility	39
Environmental Review	40
The Noise Exposure Contours and the California	
Noise Insulation Standards	40
Noise Mitigation Measures	42

APPENDICES

- A - SUGGESTED NOISE INSULATION STANDARDS FOR MENLO PARK
- B - COMMUNITY NOISE OPINION SURVEY
- C - SUGGESTED READING

FIGURES

1	Noise Element Interaction with Other Elements	3
2	Typical Sound Levels Measured in the Environment and in Industry	9
3	Zoning Map--Menlo Park Showing 1978 and 1990 L_{dn} Noise Exposure Contours	22
4	Land Use Compatibility for Community Noise Environments	41

SUGGESTED GOALS, POLICIES, AND ACTIONS

Included throughout the noise element are suggestions for improving the noise environment of Menlo Park. These suggestions are summarized here into a comprehensive set of goals, policies and actions to guide the City of Menlo Park in future efforts towards controlling noise levels.

GOALS

- To reduce noise levels in noisy areas to levels compatible with the land uses in those areas.
- To prevent the escalation of noise levels in areas where noise-sensitive uses are located.

POLICIES

- Review Federal and State noise control legislation and support legislation which is in the best interests of Menlo Park.
- Analyze in detail the potential noise impacts of any actions that the city may take or act upon which could significantly alter noise level in the community.
- Consider the compatibility of proposed land uses with the noise environment when preparing or revising community and/or specific plans.
- Encourage creative solutions when potential conflicts between noise levels and land use arise.
- Control unnecessary, excessive and annoying noises within the city where not preempted by Federal or State control.

- Enforce applicable Federal and State laws.
- Support programs to reduce community noise levels where possible to levels within the "normally acceptable" categories shown on page 41.

ACTIONS

- All development plans should be reviewed by the Community Development Department for compatibility with the noise environment. The "Land Use Compatibility for Community Noise Environments" chart on page 41 should guide this review. Acoustical reports should be required where necessary.
- Consider the adoption of a noise insulation standard that would apply to single-family homes in addition to multiple-family dwellings. The standard should also restrict maximum interior noise level due to exterior transportation noise sounds. Such a standard is included in Appendix A.
- Actively enforce the provisions of the California Motor Vehicle Code pertaining to vehicle noise emission (see page 33).
- The City of Menlo Park should consider noise emission when purchasing vehicles, construction equipment, etc. This consideration should be balanced with the required performance and cost.
- The City of Menlo Park should adopt a noise ordinance to control noise emissions from non-preempted sources, including garbage trucks.
- The City of Menlo Park should work closely with CALTRANS to reduce the levels along the state highways through the city (see page 29).
- Encourage Palo Alto Municipal Airport to encourage pilots to use the airport's suggested noise abatement takeoff pattern (see page 35).

- Closely monitor and comment on any proposed changes in Palo Alto Municipal Airport's operations that could affect noise levels in Menlo Park (see page 35).
- SAMTRANS and the school districts should be encouraged to periodically check the mufflers on their buses. As old buses are retired they should be replaced with newer, quieter models (see page 32).
- Work with the Southern Pacific Transportation Company to reduce, to the extent possible, the contribution of railroad train noise to Menlo Park's noise environment (see page 34).
- Work with neighboring communities to ensure compliance with the land use and noise compatibility goals contained in this noise element at Menlo Park's boundaries.
- The City of Menlo Park should, through the County of San Mateo, express its concerns about jet aircraft overflight noise to both the FAA and San Francisco International Airport. These administrative bodies should be encouraged to reduce to the extent possible the number of aircraft operations over Menlo Park.

SECTION I - INTRODUCTION

The Noise Element of the City of Menlo Park's General Plan has been prepared pursuant to Section 65302(g) of the California Government Code. This section requires that each city's or county's general plan shall contain a noise element. In preparing the noise element, the "Guidelines for the Preparation and Content of the Noise Element of the General Plan", prepared by the Office of Noise Control, California Department of Health, have been closely followed.

The purpose of the noise element is to form the basis for the City of Menlo Park's efforts in community noise control. The noise element is composed of the following parts:

- an evaluation of the present (1978) and future (1990) noise climate in Menlo Park;
- a discussion of the major noise sources in Menlo Park and some suggestions for their control;
- a section discussing the use of the noise element as a planning tool;
- a section summarizing actions which the City of Menlo Park can take to reduce existing noise levels and avoid future noise problems; and
- technical appendices.

The information presented in this noise element is intended to be helpful to the planning staff, the planning commission, the city council, and the citizens of Menlo Park--to help them understand the ramifications of planning decisions in terms of noise, to understand better the way that noise levels in Menlo Park occur, and to understand what the city can do to reduce these levels. This document is not intended to be a textbook on acoustics and therefore does not go into a lot of detail in technical areas such as noise barrier design, acoustical noise prediction, and noise control techniques. Rather, the noise element suggests how to determine where problems may exist and describes how to get the information necessary to avoid or mitigate possible problems.

RELATIONSHIP TO OTHER GENERAL PLAN ELEMENTS

The general plan elements are an important tool which elected officials can use to provide policy guidance to assist in decision-making. All of the elements of the General Plan are related and interdependent to some degree. However, the noise element is most closely related to the land use, housing, circulation, and open space elements as shown in Figure 1.

A major objective of the noise element is to provide guidelines to achieve noise-compatible land use. The land use and noise elements, are, therefore, closely related. The noise element, by identifying noise-sensitive land uses and establishing compatibility guidelines for land use and noise, will influence the general distribution, location, and intensity of future land use. Effective land use planning can alleviate noise problems.

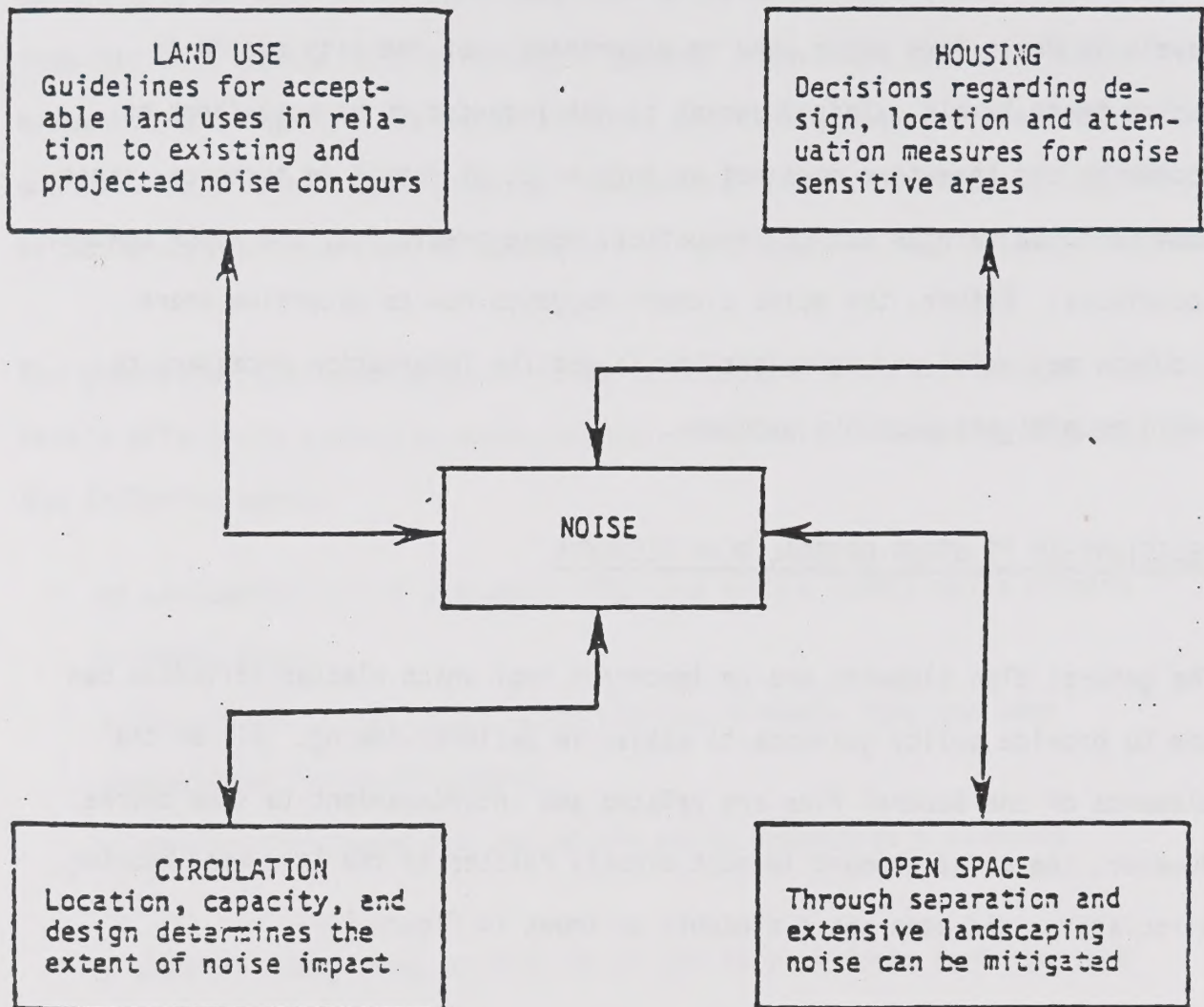


Figure 1. NOISE ELEMENT INTERACTION WITH OTHER ELEMENTS

Residential areas are one of the most noise-sensitive land uses. Therefore, the housing element is directly affected by the noise element. The housing element policies and programs should include safeguards against noise intrusion. Implementation of land use/noise compatibility guidelines can reduce noise impacts in residential locations. In addition, proper noise mitigation measures during construction of housing can guard against adverse noise impacts.

The circulation system within a city is one of the major sources of continuous noise (see Section IV, Major Noise Sources in Menlo Park). Therefore, the existing and future circulation system identified in the circulation element will greatly influence the noise environment. The circulation routes such as freeways and highways, along with truck routes, should be located to minimize noise impact upon noise-sensitive land use. The location and design of new transportation facilities and possible mitigation of noise from existing and planned facilities will greatly influence the overall noise environment within the city.

Since noise can adversely affect the enjoyment of quiet activities in open space, the noise element is also closely related to the open space element. Conversely, open space can be used as a noise buffer between incompatible land uses. This technique can reduce community noise levels and also provide usable open space for recreation.

SECTION II - FUNDAMENTAL CONCEPTS OF ENVIRONMENTAL NOISE

Understanding environmental noise requires a familiarity with the physical description of noise and the way humans react to different noises. The important physical characteristics of environmental noise include frequency, intensity, and temporal (time-varying) behavior. The effects of noise on people can be grouped in three general categories: subjective effects, interference with activities, and physiological effects.

PHYSICAL CHARACTERISTICS OF ENVIRONMENTAL NOISE

Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. The pressure fluctuation is caused by a vibrating object and is received by the ear and perceived by the brain as sound. Noise is defined as unwanted or undesired sound. The sound of a train may be music to the engineer, but may be noise to the person living on Alma Street.

Frequency

The frequency, or pitch, of a sound refers to the number of complete pressure fluctuations per second. The unit of measurement is the cycle per second (cps) or Hertz (Hz). Most of the sounds which are heard in the environment do not consist of a single frequency, but of a broad band of frequencies. The audible frequency range for humans is from about 20 Hz to 20,000 Hz.

Intensity

The intensity, or loudness, of a sound is the amount the pressure fluctuates above and below atmospheric pressure. The human ear is sensitive to a very wide range of sound pressures. A logarithmic scale, called the decibel (dB) scale in honor of Alexander Graham Bell, is used to compress this wide range. Also, people hear changes in sound intensities in proportion to the logarithm of the intensities. The threshold of human hearing corresponds roughly to 0 dB, and the threshold of pain is about 140 dB.

A-Weighting--dBA

Many rating methods have been devised to permit comparisons of sounds having quite different composition. Fortunately, the simplest method correlates with human response practically as well as the more complex methods. This method consists of evaluating all of the content of a sound in accordance with a weighting that progressively and severely deemphasizes the importance of frequency components below 1000 Hz, with mild deemphasis above 5000 Hz. This type of frequency weighting reflects the fact that human hearing is less sensitive at low frequencies and extreme high frequencies than in the mid-frequency range. The weighting curve is called "A" weighting, and the level so measured is called the "A-weighted sound level", or simply "A-level".

The A-level in decibels is expressed "dBA"; the appended letter "A" is a reminder of the particular kind of weighting used for the measurement. In practice, the A-level of a sound source is measured using a sound level meter that includes an electrical filter corresponding to the A-weighting curve. All U.S. and international standard sound level meters include such a filter. Typical A-levels measured in the environment and in industry are shown in Figure 2.

Temporal Characteristics

Although the A-level may adequately describe environmental noise at any instant in time, the fact is that the community noise level varies continuously. Most environmental noise includes a conglomeration of distant noise sources which creates a relatively steady background noise in which no particular source is identifiable. These distant sources may include traffic, wind in trees, industrial activities, etc. These noise sources are relatively constant from moment to moment, but vary slowly from hour to hour as natural forces change or as human activity follows its daily cycle. Superimposed on this slowly varying background is a succession of identifiable noisy events of brief duration. These may include nearby activities or single vehicle passages, aircraft flyovers, etc., which cause the environmental noise level to vary from instant to instant.

To describe the time-varying character of environmental noise, the statistical noise descriptors L_{10} , L_{50} , and L_{90} are commonly used. The L_{10} is considered a good measure of the "average maximum" noise level. The L_{50} is the A-weighted sound level that is equaled or exceeded 50 percent of a stated time period. The L_{50} represents the median noise level. The L_{90} is the A-weighted sound level equaled or exceeded during 90 percent of a stated time period. The L_{90} is used to describe the background noise.

As it is often cumbersome to describe the noise environment with the statistical descriptors, a single number descriptor called the L_{eq} is becoming widely used. The L_{eq} is defined as the equivalent steady-state sound level which in a stated period of time would contain the same acoustic energy as the time-varying sound level during the same time period. The L_{eq} is particularly useful in describing the subjective change in an environment where the source of noise remains the same but there is change in the level of activity. Widening roads and/or increasing traffic are examples of this kind of situation.

Day-Night Average Noise Level-- L_{dn}

In determining the daily measure of environmental noise, it is important to account for the difference in response of people to daytime and nighttime noises.

	<u>Decibels, A-Weighted</u>	
CIVIL DEFENSE SIREN (100')	140	
JET TAKEOFF (200')	130	
RIVETING MACHINE	110	ROCK MUSIC BAND
EMERGENCY ENGINE-GENERATOR (6')		
DC-10 FLYOVER (700')	100	PILE DRIVER (50')
TEXTILE WEAVING PLANT		
SUBWAY TRAIN (20')	90	BOILER ROOM
JACKHAMMER (50')		PRINTING PRESS PLANT
BULLDOZER (50')	80	GARBAGE DISPOSAL IN HOME (3')
		INSIDE SPORT CAR, 50 MPH
	75	PORTABLE LEAF BLOWER (50')
VACUUM CLEANER (10')	70	
SPEECH (1')		
	60	AUTO TRAFFIC NEAR FREEWAY
		LARGE STORE
		ACCOUNTING OFFICE
LARGE TRANSFORMER (200')	50	PRIVATE BUSINESS OFFICE
		LIGHT TRAFFIC (100')
		AVERAGE RESIDENCE
	35	MINIMUM LEVELS - RESIDENTIAL
		AREAS IN MENLO PARK AT NIGHT
SOFT WHISPER (5')	30	
RUSTLING LEAVES	20	RECORDING STUDIO
	10	
THRESHOLD OF HEARING IN		
YOUTHS (1000-4000 Hz)	0	

FIGURE 2. TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT
AND IN INDUSTRY

NOTE: The distance (in feet) between the source and listener is shown in parentheses.

Source: General Radio Company, 1972, and other data.

During the nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noises become very noticeable. Further most people are sleeping at night and are very sensitive to noise intrusion.

To account for human sensitivity to nighttime noise levels a descriptor L_{dn} (day-night equivalent sound level) was developed. The L_{dn} divides the 24-hour day into the daytime of 7 am to 10 pm and the nighttime of 10 pm to 7 am. Ten decibels are added to the nighttime noise levels. The L_{dn} is then calculated by logarithmically summing the hourly daytime and weighted nighttime L_{eq} 's.

Another commonly used 24-hour descriptor is the CNEL (Community Noise Equivalent Level). CNEL divides the 24-hour day into the daytime of 7 am to 7 pm, the evening of 7 pm to 10 pm, and the nighttime of 10 pm to 7 am. The evening noise level is weighted 5 dB, the nighttime 10 dB. CNEL is typically within one decibel of L_{dn} .

Section 65302(g) of the California Government Code requires that either the L_{dn} or CNEL descriptor be used to prepare the noise exposure contours included in noise elements of general plans. The L_{dn} descriptor is used in the Noise Element of the City of Menlo Park's Comprehensive Plan. The suggested noise insulation standards in Appendix A are in terms of CNEL. This has been done because the California Noise Insulation Standards are written in terms of this descriptor. To avoid confusion, the proposed noise insulation standard uses the same descriptor.

HUMAN REACTION TO ENVIRONMENTAL NOISE

The effects of noise on people can be grouped in three general categories:

1. Subjective effects of annoyance, nuisance, dissatisfaction;
2. Interference with activities such as speech, sleep, learning/performance;
3. Physiological effects such as startle, hearing loss.

Subjective Effects of Noise

About 10 percent of the population is so sensitive to noise that they object to any noise not of their own making. Thus, some complaints occur even in the quietest environments. Another sizable portion of the population (about 25 percent), however, does not react or complain even in very severe noise exposures. In any given noise exposure, therefore, one should expect a variety of reactions from the people exposed, ranging from serious annoyance to no awareness. Noise abatement efforts do not affect the reactions of people who are either ultrasensitive or insensitive to noise; noise control is beneficial to only the middle two-thirds of the population. People can be expected to respond to changes in level as follows:

- a) Except in carefully controlled laboratory experiments, an increase or decrease of only one dB in A-level cannot be perceived.
- b) Outside of the laboratory, a three-dB increase or decrease in A-level is considered a just-noticeable difference.

- c) An increase or decrease in A-level of at least five dB is required before any noticeable change in community response would be expected.
- d) A ten-dB increase in A-level is subjectively heard as a doubling in loudness, and would almost certainly cause adverse change in community response. A ten-dB decrease in A-level is subjectively heard as a halving in loudness and represents a significant improvement in a noise environment.

It has been found that people in different types of neighborhoods have different reactions to noise. For a given noise level increase, instances of annoyance, disturbance and complaint will be greatest for rural areas, followed by suburban/urban residential, commercial and industrial areas in decreasing order. Similarly, a given noise will be more disturbing to people at night than during the day. Seasonal variations have also been noted; noise is more disturbing in summer than in winter.

It has been demonstrated that if a noise problem is allowed to occur a reduction in noise level of from 5 to 10 dBA more than would have been required in the design stage is often necessary to appease complainants. For this reason it is very important to consider noise control early in the development of a project.

Interference with speech communication. People generally have the ability to hear and distinguish one sound from a background of sounds. For example, one can often hear the telephone ringing over a background of music and conversation. However, this ability has definite limitations. Unwanted sound can interfere with the perception of desired sounds or signals; this interference is called masking. Masking can render a sound or a signal inaudible or unrecognizable. Masking becomes a serious problem when background noise interferes with perception of speech. Accurate speech communication is crucial to formal education, occupational efficiency, family relationships, and the overall quality of human life. This function may be lost or severely diminished in noisy situations.

Background noise that interferes with speech can adversely affect the development of social and working relationships in adults. In language studies, people have been found to vary their voice levels and distances in accordance with the level of background noise, physical convenience, and cultural standard. Person-to-person distances of less than 4 ½ feet tend to be reserved for confidential or personal conversations, usually with a lowered voice, while distances greater than about five feet are usually associated with public messages delivered with a raised voice. Therefore, levels of background noise requiring the distance between talker and listener to be less than four feet may discourage communication among and be upsetting to persons not intimately associated. Similarly, there will be great reluctance to raise the voice level to deliver a personal message, even if this is necessary for speech intelligibility.

Face-to-face personal conversations at the usual distance of about five feet can proceed in A-weighted noise levels as high as 66 dB. In many conversations involving groups of people, distances between speaker and listener of five to twelve feet are common, and the level of the background noise should be less than 50 to 60 dBA. At public meetings or outdoors in parks, yards or playgrounds, where distances between talker and listener range from twelve to thirty feet, the A-weighted sound level of background noise should be kept below 45 to 55 dB, if practical speech communication is to be possible.

Interference with sleep. Sleep is a complicated series of states, generally following similar patterns in people of all ages. The amount of time spent in the different states which comprise a night of sleep vary from the drowsy/awake state to the deep sleep state and back again. It has been widely observed that sound can interfere with any of sleep's stages and that people can acclimate themselves to certain noises and sleep through them. It is possible that only unfamiliar environmental sounds disturb sleep. For example, a rural person may have difficulty sleeping in a noisy urban area while an urban person sleeping in a rural area may be disturbed by the soft nighttime sounds of the countryside.

Intermittent noises of sufficient intensity alter the normal pattern of sleep, usually in the direction of lighter sleep. Long-term sleep disturbance by noise produces a "poor" sleep pattern with long periods of

light sleep and frequent awakenings. Sleep is essential to normal functioning while awake, but loss of normal sleep has not been shown to cause adverse health effects. Most people can eventually adjust a disturbed sleep pattern and compensate by spending more time in deep sleep, becoming less responsive to external stimuli, or by napping.

No range of noise levels has been established as the minimum range at which sleep disturbance occurs. As a person experiences the deepening stages of sleep, the threshold of noise perception becomes higher. For instance, in the second stage of sleep ("moderate"), a noise 30 to 40 dBA above a person's threshold of hearing while conscious will be required to wake that person; in deep sleep, a noise must reach sound levels 50 to 80 dBA above that threshold to wake the person. Of course, very loud, brief noises (with sound levels of 100-120 dBA) will wake nearly everyone from any stage of sleep.

Interference with performance and learning. Noises seemingly begin to interfere with human performance when the A-weighted level exceeds 90 dBA. High frequency noise (above about 1000-2000 Hz) or irregular bursts of noise are more distracting and may produce more performance interference than low frequency noise or steady noise. The performance of tasks demanding accuracy or having a complex series of steps is most likely to be adversely affected, without necessarily reducing the total amount of work performed. Learning, especially in small children, can be seriously hindered by the presence of high or constant levels of background noise,

since the noise can be a barrier to speech perception and exchange (as previously mentioned). For children, this interference may have far-reaching detrimental effects, because speech communication is extremely important in developing language and reading skills.

Noise effects on human performance can be grouped in three classes:

1) arousal; 2) distraction; and 3) specific effects. Arousal of bodily systems can result either in detrimental or beneficial effects on human performance, depending upon the nature of the task and the person's state prior to the exposure. For example, noise might induce muscular tension which could interfere with delicate movements, while a sleepy person might be beneficially aroused by the noise and perform more effectively in noise than in quiet. Distraction has been defined as a lapse or diversion of attention from the task at hand, and most often is the result of annoying characteristics of a noise. Specific effects include masking and muscular activation such as startle.

Physiological Effects of Noise

The sound levels associated with environmental noise, in almost every case, produce effects only in the first two categories we have described. Yet, at any given sound level, individual responses will vary considerably, and physiological effects of a transient or possibly persistent nature may result. Brief sounds at levels exceeding 70 dBA can produce such physiological responses as general constriction of the blood vessels and changes in breathing, size of the pupils of the eyes, and gastric secretions. Steady

noises of 90 dBA have been shown to increase tension in all muscles, and influence the response time in a simple choice task. Long-term exposure to levels exceeding 70 dBA can cause hearing loss. While physiological arousal by noise can be beneficial in maintaining response to possible danger, continuing unnecessary arousal to irrelevant sounds can be annoying and possibly damaging to general health.

SECTION III - NOISE CLIMATE OF THE CITY OF MENLO PARK-- PRESENT (1978) AND FUTURE (1990)

This section describes in quantitative and qualitative terms the noise climate in the City of Menlo Park. Included are:

- the noise exposure contours for the major transportation sources within the City of Menlo Park for 1978 and 1990;
- the results of noise measurements made throughout Menlo Park in April and May of 1978;
- the results of an opinion survey describing how the citizens of Menlo Park view their noise environment; and
- a community noise inventory showing the number of people in Menlo Park exposed to various levels of environmental noise.

NOISE EXPOSURE CONTOURS

Section 65302(g) of the California Government Code requires:

"...noise exposure contours for both near and long-term levels of growth and traffic activity. Such noise exposure information shall become a guideline for use in development of the land use element to achieve noise compatible land use and also to provide baseline levels and noise source identification for local noise ordinance enforcement.

"The sources of environmental noise considered in this analysis shall include, but are not limited to, the following:

- (1) Highways and freeways.
- (2) Primary arterials and major local streets.
- (3) Passenger and freight on-line railroad operations and ground rapid transit systems.
- (4) Commercial, general aviation, heliport, helistop, and military airport operations, aircraft overflights, jet engine test stands, and all other ground facilities and maintenance functions related to airport operation.
- (5) Local industrial plants, including, but not limited to, railroad classification yards.
- (6) Other ground stationary noise sources identified by local agencies as contributing to the community noise environment.

"The noise exposure information shall be presented in terms of noise contours expressed in community noise equivalent level (CNEL) or day-night average level (L_{dn}). CNEL means the average equivalent A-weighted sound level during a 24-hour day, obtained after addition of five decibels to sound levels in the evening from 7 pm to 10 pm and after addition of 10 decibels to sound levels in the night before 7 am and after 10 pm. L_{dn} means the average equivalent A-weighted sound level during a 24-hour day, obtained after addition of 10 decibels to sound levels in the night before 7 am and after 10 pm.

"The contours shall be shown in minimum increments of 5 dB and shall continue down to 60 dB. For areas deemed noise sensitive, including, but not limited to, areas containing schools, hospitals, rest homes, long-term medical or mental care facilities, or any other land use areas deemed noise sensitive by the local jurisdiction, the noise exposure shall be determined by monitoring.

"The state, local, or private agency responsible for the construction, maintenance, or operation of those transportation, industrial or other commercial facilities specified in paragraph 2 of this subdivision shall provide to the local agency producing the general plan, specific data relating to current and projected levels of activity and a detailed methodology for the development of noise contours given this supplied data, or they shall provide noise contours as specified in the foregoing statements."

The noise exposure contours for the City of Menlo Park are shown in Figure 3. The noise contours are shown in terms of the day-night average noise level (L_{dn}). For community noise the L_{dn} is typically within 1 dBA of the community noise equivalent level (CNEL). Throughout this noise element the L_{dn} is the metric used.

The contours depict the 1978 and 1990 noise exposure for the following sources:

- Highway 101
- Highway 84 (Willow Road east of Highway 101)
- Highway 82 (El Camino Real)
- Highway 280
- Major local streets
- Southern Pacific Railroad (Mainline and Dumbarton Branch line)
- Palo Alto Municipal Airport

No industrial plants or other ground stationary noise sources were identified as significant (i.e., none were found which generate a 60 L_{dn} contour off their property).

The contours shown on Figure 3 depict the 1990 noise exposure for the City of Menlo Park. In most cases the 1990 noise levels are not expected to increase by a noticeable amount over today's noise levels. In those cases where an increase of more than 1 dBA is expected between now and 1990, the 1978 noise exposure level is shown in parentheses on the noise exposure map. (A 1000' scale map is on file in the Community Development Department.)

The information used to generate the noise exposure contours came from several different sources: the State Highway noise contours were generated from information supplied by the California Department of Transportation (CALTRANS), District 4; the railroad noise contours were generated from information supplied by the Southern Pacific Transportation Company; the City of Menlo Park's Engineering Department provided the input for the generation of the noise contours for the major local streets; and the Palo

Alto Airport noise contours were adopted from the Santa Clara County Airport Land Use Commission (ALUC) Plan for area surrounding Santa Clara County Airports.

Noise measurements were made to validate the contours for the two Southern Pacific railroad lines and to validate the contours for Highways 101 and 84. The results of the validation measurements are reflected in the contours. In developing the noise contours, shielding due to intervening structures, walls, berms and terrain changes was also taken into account.

NOISE MEASUREMENTS

Noise measurements were made throughout the City of Menlo Park in April and May of 1978 by Charles M. Salter Associates, Inc., consultants in acoustics. The noise measurement sites were chosen so that some of the sites would be close to major transportation noise sources, while others would be distant from these major noise sources. The data from the sites close to the major transportation noise sources were used to validate the noise exposure contours. The data from the sites distant from major noise sources were used to provide information on the noise environment in those portions of Menlo Park where noise from a single source does not dominate the noise environment.

The noise measurements were made on weekdays. On weekends there tends to be less traffic in the early morning hours and in the evening. There are also fewer trucks on the road on weekends. The weekend noise environment is therefore somewhat less affected by transportation noise.

Noise measurements were made at 13 sites in Menlo Park. Four sites were monitored continuously for a 24-hour period and nine sites were monitored three times a day for 15 minutes each time. The time periods chosen to monitor the nine sites were: 7 am to 9 am or 3:30 pm to 6 pm, corresponding to rush traffic hours; 9 am to 3:30 pm, representing mid-day noise conditions; and 10 pm to 7 am representing nighttime noise conditions. The results of the measurements during the three time periods were combined mathematically to provide an estimate of the day-night average noise level (L_{dn}) at each of these sites. The L_{dn} s at each of the sites monitored for 24 hours were calculated from the hour-by-hour data. The noise measurement sites are shown on the noise exposure map (Figure 3) along with the measured L_{dn} at each site. The data sheets showing the results and the contributing noise sources are on file with the Community Development Department.

COMMUNITY NOISE OPINION SURVEY

In May and June of 1978 the Department of Community Development administered an informal survey of the attitudes of Menlo Park's citizens towards their noise environment. A questionnaire listing various types of noise sources was published in a local newspaper and made available at City Hall. One hundred and thirty-five responses were received.

The opinion survey indicates that transportation noise sources are the major cause of annoyance among Menlo Park citizens; automobiles, trucks, buses, motorcycles and trains being most often cited as problems. However, localized noise problems such as portable leaf blowers, amplified music and barking dogs were also noted. The summarized results of the survey are found in Appendix C.

NOISE EXPOSURE INVENTORY

Section 65302(g) of the California Government Code requires that "a part of the noise element shall also include the preparation of a community noise exposure inventory, current and projected, which identifies the number of persons exposed to serious levels of noise throughout the community". Based on the location of the noise contours shown in Figure 3, and on 1978 and 1990 population projections the following table shows the number of persons in the City of Menlo Park exposed to various levels of environmental noise:

<u>Noise Level (L_{dn})</u>	<u>1978</u>	<u>Persons</u>	<u>1990</u>
60 - 65	4300		4400
65 - 70	3000		3100
70 - 75	1800		1700
75 - 80	700		700
	9800		9900
			TOTAL

The table shows that there could be a slight increase in the number of persons exposed to an L_{dn} of greater than 60 dBA in 1990. Although this small change is not significant, implementation of the mitigation measures suggested in this noise element would reduce the number of people exposed to a given noise level.

SECTION IV - MAJOR NOISE SOURCES IN MENLO PARK AND SUGGESTIONS FOR THEIR CONTROL

All communities are faced with two types of noise control problems. There are noise problems which have been in existence for years and if nothing is done will continue as problems, and there are problems that if not carefully thought out may exist in the future. In this section we present a discussion of the major existing noise sources in Menlo Park and suggestions for the reduction of their contribution to the overall noise level in the City of Menlo Park. As is discussed in Section V of the noise element dealing with land use planning, the California State Office of Noise Control, and the acoustical community in general have agreed that residential uses are compatible with a noise environment that does not exceed an L_{dn} of 60. It is true that residential developments coexist with noise levels far exceeding an L_{dn} of 60; indeed, in Menlo Park a few residences are located where the L_{dn} reaches 80. These residences are located on Highway 101 between Willow Road and Del Norte Avenue. Clearly, the people who live in these residences are exposed to an unacceptable noise level. The problem is how to reduce the noise exposure in all residential areas of Menlo Park to as close to 60 L_{dn} as possible.

Control or abatement of a noise problem in Menlo Park can be accomplished in any one or combination of three ways. One can quiet the source of noise or remove it; one can protect the receiver of the noise; or one can block the path between the source of noise and the receiver to reduce the noise level. One other option, to isolate or remove the receiver of the noise, is not a feasible solution in Menlo Park. All three of these areas should

be pursued to reduce the noise exposure in Menlo Park. The major noise sources in Menlo Park--Highway 101, the railroads and the major local streets--can be controlled only by a combination of federal, state, and local efforts. The private citizen can, however, choose quiet modes of transportation. Citizens can also reduce noise in their neighborhoods simply by not revving their engines unnecessarily, squealing their tires around the corners, honking horns to announce an arrival, and generally just making unnecessary noise. Many of the things which are covered in noise ordinances are only there because people are discourteous. For example, if it is midnight and one is aware their neighbor is sleeping, it does not make sense to begin using a power saw to build a new picnic table. Common courtesy and noise control go hand-in-hand.

Because transportation noise sources are the biggest noise generators in the City of Menlo Park this section begins with these sources and concludes with a discussion of what can be done about some of the minor sources of noise found in Menlo Park.

U.S. HIGHWAY 101

By far the greatest generator of continuous high noise levels in Menlo Park is Highway 101. Residents living adjacent to Highway 101 are exposed to an L_{dn} of up to 80 dBA. This is 20 dBA higher than the recommended level for residential areas of 60 L_{dn} suggested in the land use compatibility guidelines discussed later in this noise element. The noise level along Highway 101 in the yards of the nearest residents prohibits conversation at

normal vocal levels. Even inside these homes with the windows closed highway noise is constantly audible as a background roar. Clearly this is a noise source that should be dealt with.

The noise generated by Highway 101 is caused by a large number of trucks and automobiles traveling at high speeds. This high noise level coupled with the fact that residences are located close to the road result in a serious noise problem. In this case mitigation can best be accomplished by the erection of a noise barrier (see page 39 for a discussion of noise barrier construction) between the homes and Highway 101. A properly engineered and constructed noise barrier could reduce noise levels by 10 to 15 dBA along Highway 101 through Menlo Park. This would be a dramatic improvement in the noise environment.

The California Department of Transportation (CALTRANS) has a program for providing noise barriers along existing freeways. The program is based on a prioritized list of noisy locations in California. The City of Menlo Park should keep in touch with CALTRANS to insure that Highway 101 through Menlo Park is on this list. The city should also let CALTRANS know that it considers the reduction of noise levels along this stretch of Highway 101 a priority item.

A noise barrier would provide a reduction in both interior and exterior noise levels for all the homes behind the barrier, and would therefore provide the greatest benefit in terms of reduction in the overall community noise level.

It is possible however for individual homeowners to reduce noise levels inside their homes by modifying the construction of their homes. The cost of these modifications depends upon the degree of noise reduction desired.

STATE HIGHWAY 84

State Route 84 between the Dumbarton Bridge and Highway 101 is the second most significant traffic noise generator in Menlo Park. The multi-family housing along the north side of Route 84 in this area is exposed to an L_{dn} greater than 70. (For purposes of orientation, El Camino Real is assumed to run north and south.) A noise barrier is not presently feasible because of the short setbacks of these units from the curb and the need for access directly to Route 84. If the right-of-way is shifted as a result of a widened Dumbarton Bridge, the feasibility of a noise barrier should be reexamined. If the new right-of-way "takes" the housing, more compatible land uses (e.g., office, commercial) should be considered for this location.

As accelerating vehicles emit more noise than vehicles traveling at a constant speed (especially vehicles with a low power-to-weight ratio--Volkswagens, for example), opportunities to smooth out traffic flow on major streets should be looked for. Timing street lights to reduce the amount of acceleration along a stretch of road can eliminate some of this acceleration noise and improve the noise environment. Opportunities to smooth out traffic flow should be examined on all major streets including Highway 84.

STATE ROUTE 82

State Route 82 is El Camino Real through Menlo Park. Primarily commercial land uses adjoin Route 82 with some residences located near the north and south boundaries of Menlo Park. Noise levels adjacent to Route 82 are not compatible with residential land use; therefore future residential development along Route 82 should be generally discouraged. Careful site planning and other noise mitigation measures should be a required part of any future residential development along Route 82. Less noise-sensitive land uses should be encouraged along this highway.

INTERSTATE ROUTE 280

Interstate 280 runs along the western edge of Menlo Park. Adjacent land uses include the Sharon Heights Golf Course, some condominiums, and commercial areas. By 1990, because of increased traffic on Route 280, noise levels are expected to increase about 5 dBA over the existing level. As all development in this area is either completed or approved for completion, mitigation of this noise increase will be difficult to achieve. Since there are no planning options, the only methods available are to add noise walls where feasible and/or retrofit dwelling units to decrease interior noise levels where necessary.

TRUCK AND BUS ROUTES IN MENLO PARK--MAJOR STREETS

Trucks traveling east-west through Menlo Park mainly use the following route: Willow Road to Middlefield Road, Middlefield Road to Ravenswood Avenue, Ravenswood Avenue to El Camino Real, and then either Menlo Avenue or Santa Cruz Avenue to Sand Hill Road. This route may change when Ravenswood is reconstructed to align with Menlo Avenue and more trucks may use Menlo Avenue and University Drive than presently do. As is shown on the noise exposure map, noise levels along these streets are generally higher than along other streets in Menlo Park. The City of Menlo Park should study all possible truck routes through the city to insure that the least noise-sensitive route is used.

Bus routes in Menlo Park have also been identified by the citizens of Menlo Park as a noise problem. Both school buses and SamTrans buses have been the cause of complaints. The school buses, being older than the SamTrans buses, are noisier. The main problem with either type of bus is that in a quiet residential area the noise emitted by these vehicles stands out sharply against the background noise level.

To insure that as few people as possible are impacted by noise from either the SamTrans buses or the school buses, SamTrans and the school district should be encouraged to periodically check the mufflers on their buses. The

size of bus chosen for a particular route should be consistent with the expected number of passengers. As old buses are retired they should be replaced with newer quieter models. As with the truck routes, bus routes should be evaluated in terms of the number of residences exposed to bus routes and the least noise-sensitive routes should be chosen.

INDIVIDUAL VEHICLES--TRUCKS, BUSES, MOTORCYCLES AND AUTOMOBILES

One of the most annoying sources of noise in any community, and Menlo Park is no exception, is unmuffled or improperly muffled motor vehicles. Not only are these vehicles annoying but they are illegal. Section 27150 of the California Motor Vehicle Code requires that all vehicles be equipped with a properly maintained muffler. Section 27151 makes it illegal to modify the exhaust system of any vehicle. Enforcement of these sections of the vehicle code does not require the use of a sound level meter to prove a violation. Identification of unmuffled vehicles and/or vehicles with modified exhaust systems is easy and it should be the routine procedure of the Menlo Park Police Department to cite all offenders. In addition to the muffler regulations Section 23130.5 of the vehicle code sets quantitative noise emission limits for different vehicle classes. Enforcement of this section requires noise monitoring equipment and trained personnel. Since almost all the vehicles that violate the quantitative limits have faulty or modified exhaust systems, it is generally more cost effective for a city to cite noisy vehicles under sections 27150 and 27151.

TRAINS

The highest maximum noise levels in the City of Menlo Park are generated by trains using the two railroad lines that pass through the city. For example, the train engines emit about 95 dBA at 100 feet from the tracks. The warning horns emit about 100 dBA at 100 feet from the train. All of the commute trains and the majority of the freight trains use the main line tracks through the heart of the city; the remaining freight operations take place along the Dumbarton Branch line on the eastern edge of the city.

To reduce train noise the city should:

- urge Southern Pacific to maintain tracks, joints, switches, etc., in a condition that will avoid excessive wheel-to-rail noise generation;
- urge Southern Pacific to find ways to reduce their traffic between 10 pm and 7 am;
- suggest reduced speed limits during the hours of 10 pm and 7 am.

The warning horns used by the trains at at-grade crossings are required by law. One method that would of course eliminate this noise source would be to eliminate at-grade crossings. When the opportunity arises to evaluate the elimination of an at-grade crossing the city should consider the benefits of reduced noise emission.

GENERAL AVIATION AIRCRAFT

Citizens have complained of noise generated by light planes flying over Menlo Park, particularly over eastern Menlo Park. These planes appear to be from Palo Alto Municipal Airport but could be from any of several other Bay Area general aviation airports.

Control of the noise generated by aircraft is in the hands of the Federal Aviation Administration (FAA) who control aircraft in flight. FAA regulations require that planes be at a minimum altitude of 1000 feet as they pass over a residential area. In addition to this regulated minimum, the suggested noise abatement takeoff pattern for the Palo Alto Municipal Airport is that planes turn right over the bay after takeoff to gain an altitude of 1500 feet. After reaching this altitude the planes can then turn back over the peninsula. This takeoff pattern is only a suggestion and cannot be strictly enforced. Under adverse weather conditions it is often necessary for planes to pass over Menlo Park at less than 1500 feet, creating noise levels higher than normal.

The City of Menlo Park should encourage the Palo Alto Municipal Airport to stress the importance of the noise abatement takeoff pattern to its pilots. The city should also actively participate in the review of any plans for future operational changes at the airport. By closely monitoring any proposed changes the city can work to avoid an increase in aircraft noise in Menlo Park.

JET AIRCRAFT

Citizens have also complained of noise generated by jet aircraft passing over Menlo Park. The majority of these aircraft are on approach to San Francisco International Airport. Although the L_{dn} noise level due to jet aircraft alone does not measurably alter the noise environment of the City of Menlo Park, the distinctive sound of these jets is particularly annoying to some people. This noise source could be eliminated if flights did not pass over Menlo Park. However because of the tremendous number of aircraft operations in the San Francisco Bay Area it is impossible for safety reasons to direct all flights over unpopulated areas. The Federal Aviation Administration (FAA) does however consider citizen's complaints and community concerns when assessing modifications to flight tracks.

The City of Menlo Park should, through the County of San Mateo, express its concerns about jet aircraft overflight noise to both the FAA and San Francisco International Airport. Specifically these administrative bodies should be encouraged to reduce to the extent possible the number of aircraft operations over Menlo Park.

MISCELLANEOUS NOISE SOURCES

The following noise sources have also been identified as common problems in the City of Menlo Park. Each item is followed by a brief discussion of possible mitigating techniques.

Dogs. Barking dogs, especially during the night, are particularly annoying. Generally this barking is totally unnecessary as dogs can be taught to keep from barking unless a stranger intrudes. A well-trained watchdog does not bark and howl without a good reason. The City of Menlo Park should issue warnings to owners of barking dogs reported by neighbors and, after thirty days, issue citations to owners of repetitive offenders. Thirty days is generally sufficient time to teach any dog to keep quiet, except in a situation when barking is required to raise a bona fide alarm.

Power Tools. Power saws, leaf blowers and other assorted power tools are often annoying to neighbors. Because of the vast variety of power tools in use and also because some are used exclusively outdoors it is difficult to enforce fixed noise emission limits. It is a simple matter however to control the hours during which these tools are used. The city should consider adopting a noise ordinance which restricts the usage of power tools to the hours of 8 am to 10 pm during weekdays and 9 am to 9 pm on weekends. In addition citizens should be encouraged to buy the quietest available tools and to operate power tools in their garages whenever possible to reduce noise generation.

Other Sources. There are many other activities which generate noise and which may cause annoyance. Amplified music, public address systems, radios, etc., are best controlled through the adoption of a quantitative community noise ordinance. The City of Menlo Park should adopt an ordinance that would set maximum noise limits for the receiving land use.

Noise Sources Outside of the City of Menlo Park Limits. There may from time to time be conflicts between noise sources located outside of Menlo Park boundaries and receivers located in Menlo Park. To facilitate the resolution of these conflicts, adjacent localities should be made aware of Menlo Park's noise ordinance, when it is adopted; and be encouraged to adopt a similar one.

SECTION V - THE NOISE ELEMENT AS A PLANNING TOOL

The noise exposure contours for the City of Menlo Park provide baseline information that will be very useful in the city's planning efforts. Some of the more important uses follow.

EXTERIOR NOISE LEVELS AND LAND USE COMPATIBILITY

Over the years many studies have been performed to determine how much noise is acceptable for different land uses. Figure 4, based on a chart developed by the Office of Noise Control in the California Department of Health, summarizes this information. The chart shows, for various land uses, the noise level (L_{dn} or CNEL) below which the land use would be considered compatible with the exterior noise environment with no special noise insulation requirements. The chart also shows the noise level above which the land use would be considered unacceptable due to the difficulty of providing the required noise reduction. The chart indicates that there is often a large range of exterior noise levels for which a land use could be made compatible if the necessary noise reduction features are included in the design of the project. The land use compatibility chart used in conjunction with the noise exposure contours will therefore provide additional input into the decision-making process. Proposals to rezone parcels, for example, can be quickly evaluated for any potential conflicts with the existing noise environment.

ENVIRONMENTAL REVIEW

In a more specific sense the noise exposure contours are the city's noise data base, and will be of interest to all who prepare EIRs or are involved in the environmental impact review process. For the planning staff the contours and the land use compatibility chart will be helpful in identifying the potential noise impacts associated with a project during the initial study phase. Those who prepare EIRs will use the noise exposure maps to help them in identifying noise impacts.

THE NOISE EXPOSURE CONTOURS AND THE CALIFORNIA NOISE INSULATION STANDARDS

The California Noise Insulation Standards (Title 25 of the California Government Code) for multi-family dwellings requires an acoustical report for dwellings proposed in areas where the L_{dn} exceeds 60 dBA. The purpose of the acoustical report is to demonstrate the manner by which the development will meet the standards for interior noise levels. The 1990, 60 L_{dn} noise contour on the noise exposure map should be used to determine where a noise measurement will be required to determine compliance with the standard. In those cases where the development would be located in an area where the L_{dn} exceeds 60, on-site noise measurement should be required--because local conditions on-site may cause somewhat different noise levels than the contours show. If the noise measurement shows that the on-site L_{dn} exceeds 60 then the acoustical report would be required. Developments located outside the 60 L_{dn} contour would not require a measurement, as in general the noise contours slightly overestimate the noise level.

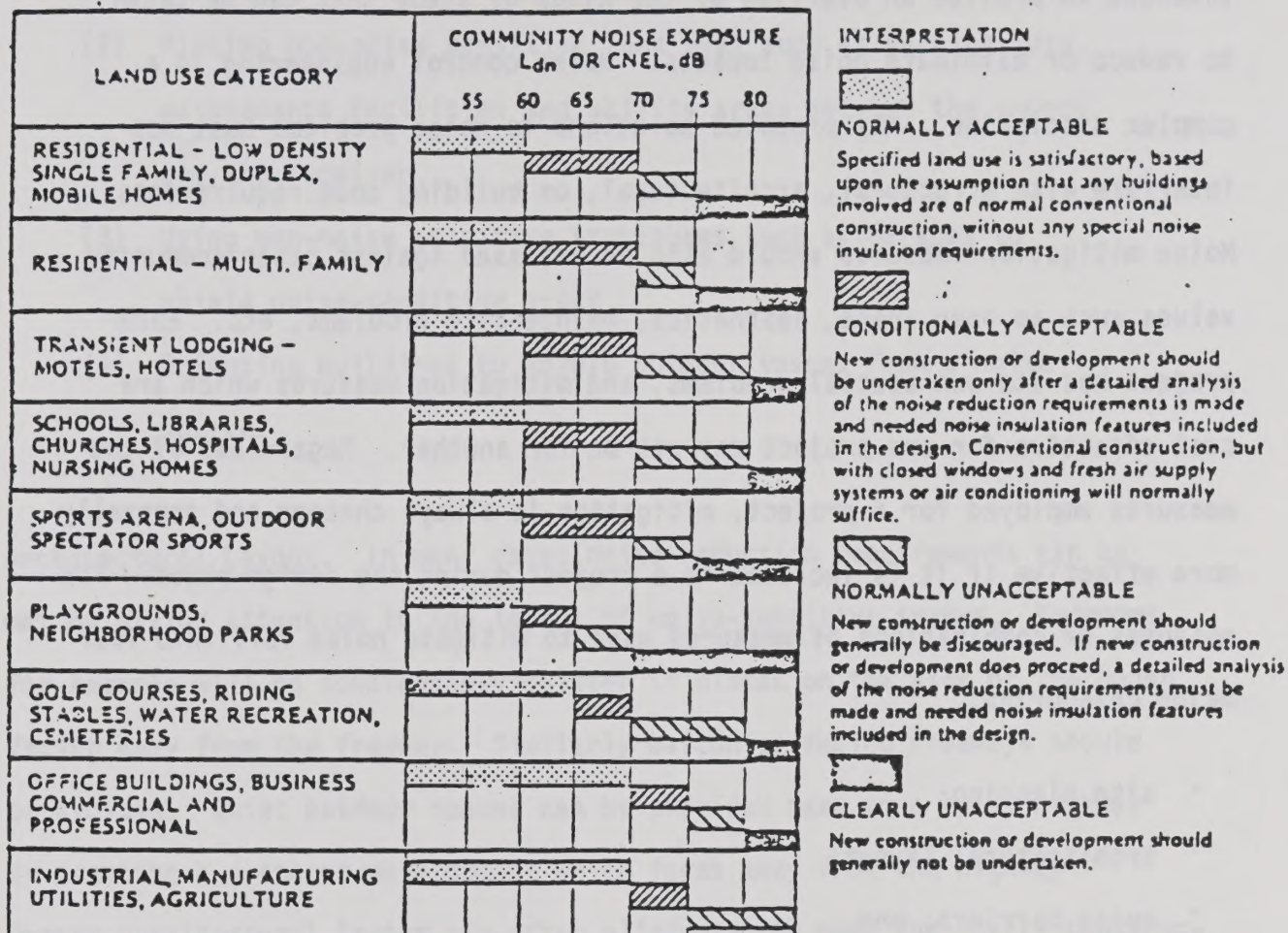


Figure 4. LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENTS

NOISE MITIGATION MEASURES

In some situations it is necessary to construct noise-sensitive developments in noisy areas. The following discussion of noise mitigation measures is intended to provide an overview of the kinds of steps that can be taken to reduce or eliminate noise impacts. Noise control engineering is a complex discipline. Any proposed solutions to noise problems must not interfere with structural, architectural, or building code requirements. Noise mitigation measures should also be assessed against other community values such as open space, aesthetics, maintenance problems, etc. Each project has its own special problems, and mitigation measures which are cost effective for one project may not be for another. Regardless of the measures employed for a project, mitigation is always cheaper and generally more effective if it is included in a project during the design phase. The measures or combinations of measures used to mitigate noise fall into four major categories:

- site planning;
- architectural layout;
- noise barriers; and
- construction modifications.

Site Planning. Proper site planning to reduce noise impacts is the first area that should be investigated for a given project. By taking advantage of the natural shape and contours of the site it is often possible to arrange the buildings and other uses in a manner which will reduce and

possibly eliminate noise impact. Planned unit developments are particularly conducive to site planning techniques. Site planning techniques include:

- (1) Increasing the distance between the noise source and the receiver.
- (2) Placing non-noise sensitive land uses such as parking lots, maintenance facilities and utility areas between the source and the receiver.
- (3) Using non-noise sensitive structures such as garages to shield noise-sensitive areas.
- (4) Orienting buildings to shield outdoor spaces from a noise source.

Architectural Layout. In many cases noise reduction requirements can be met by giving attention to the layout of noise-sensitive spaces. Bedrooms for example will be considerably quieter if placed on the side of the house facing away from the freeway. Similarly balconies facing freeways should be avoided. Quiet outdoor spaces can be provided next to a noisy highway by creating a u-shaped development which faces away from the highway. Proper architectural layout can often eliminate the need for costly construction modifications.

Noise Barriers. Noise barriers or walls are commonly used to reduce noise levels from ground transportation noise sources and industrial sources. Noise barriers serve a dual purpose in that they can reduce the noise level both outdoors and indoors.

To be effective a noise barrier must be massive enough to prevent significant noise transmission through it and high enough to shield the receiver from the noise source. The minimum acceptable surface weight for a noise barrier is 4 lbs./sq. ft. (equivalent to 3/4" plywood) and the barrier must be carefully constructed so that there are no cracks or openings. To be effective a barrier must interrupt the line-of-sight between the noise source and the receiver. As an example of this relationship consider a flat area with a housing tract next to a road. If there are no diesel trucks on the road, a 7-foot high barrier will reduce the traffic noise by about 8 dBA. If there are trucks then the noise from the trucks will only be reduced by about 4 dBA. The reason is that the stacks of the diesel trucks will be visible above the barrier and the noise path will not be completely interrupted.

Another important and often overlooked consideration in the design of noise barriers is the phenomenon of "flanking". Flanking is a term used to describe the manner by which a noise barrier's performance is compromised by noise passing around the end of a barrier. Short barriers regardless of height provide essentially no reduction in the overall noise level. The effects of flanking can be minimized by bending the wall back from the noise source at the ends of the barrier.

In addition to meeting acoustical requirements, noise barriers must be evaluated for possible maintenance problems, aesthetic and environmental considerations, safety conflicts and cost.

Construction Modifications. If site planning, architectural layout, noise barriers or a combination of these measures do not achieve the required noise reduction for the building in question, it will be necessary to modify the building's construction. Indoor noise levels due to exterior sources are controlled by the noise reduction characteristics of the building shell. The walls, roof, ceilings, doors, windows and other penetrations are all determinants of the structure's overall noise reduction capabilities.

In general windows and doors are the acoustical weak links in a building. Often all that is required is that the windows be sealed on the noisy side of the building and an alternate means of ventilating the building provided. Beyond this, thicker windows or doubled-glazed windows will be required. Doors should not be located on the side of the building facing a noisy source. If they are, they should be solid-core doors and should be equipped with an appropriate acoustical door gasket.

In cases where more noise reduction is required the ceiling/roof and/or the walls must be modified to provide the required noise reduction. The actual modifications will depend on the amount of noise reduction required.

APPENDIX A

SUGGESTED NOISE INSULATION STANDARDS FOR THE CITY OF MENLO PARK

The following suggested noise insulation standard is tailored after the State of California's Noise Insulation Standard (Title 25, Section 1092, of the California Administrative Code). The suggested standard differs from the state standard in two major areas. First, the suggested standard extends application to single-family dwellings. Second, the suggested standard contains a limitation on maximum interior noise levels for single events.

PURPOSE

The purpose of this article is to establish uniform minimum noise insulation performance standards to protect persons within new multi-family dwellings--hotels, motels, apartment houses and other--and single-family dwellings from the effects of excessive noise, including but not limited to hearing loss or impairment and persistent interference with speech and sleep.

APPLICATION

These regulations shall apply to all applications for building permits made subsequent to the effective date of these regulations.

These regulations shall be effective months after adoption by the Menlo Park City Council.

DEFINITIONS

1. Impact Insulation Class (IIC)--a single number rating for ceiling/floor construction that represents the ability of the construction to isolate impact noise, where measurement procedure is based on ASTM E492-73T and as defined in UBC Standard No. 35-2.
2. Sound Transmission Class (STC)--a single figure rating for floor/ceiling and interior wall partition construction that represents the ability of the construction to isolate airborne noise, where measurement procedure is based on ASTM E90-75 or ASTM E336-77 and as defined in UBC Standard No. 35-1.
3. Dwelling, Single-Family--"Single-family dwelling" means a building, containing not more than one kitchen, designed for, or used to house not more than one family, including all necessary employees of such family.
4. Community Noise Equivalent Level (CNEL)--the community noise equivalent level in dBA is the average noise exposure level over a 24-hour period. The CNEL is based on hourly L_{eq} s. These hourly L_{eq} s are penalized to account for the lower tolerance of people to noise during the evening and nighttime periods. The hourly L_{eq} s from 7 pm to 10 pm are penalized by +5 dBA and the hourly L_{eq} s from 10 pm to 7 am are penalized by +10 dBA.
5. Design Maximum Noise Level--for the purpose of this article, the design maximum noise level means the maximum A-weighted sound level outside of the units in question emitted under normal operating conditions by vehicles using a state highway or freeway, local expressway, major arterial, railroad or rapid transit line; by aircraft; and by industrial or other fixed sources.

The design maximum noise level shall be verified by the person preparing the acoustical report. In making the calculation, parameters which will affect noise emissions should be taken into account. These parameters will include speed, grade, distance, barrier effects, etc.

SOUND TRANSMISSION CONTROL BETWEEN DWELLING UNITS IN MULTI-FAMILY DWELLINGS

1. Wall and Floor/Ceiling Assemblies--wall and floor/ceiling assemblies separating dwelling units or guest rooms from each other and from public space such as interior corridors and service areas shall provide airborne sound insulation for walls, and both airborne and impact sound insulation for floor/ceiling assemblies.
2. Airborne Sound Insulation--all such separating walls and floor/ceiling assemblies shall provide an airborne sound insulation equal to that required to meet a Sound Transmission Class (STC) of 50 (45, if field tested) as defined in UBC Standard No. 35-1.

Penetrations or openings in construction assemblies for piping, electrical devices, recessed cabinets, bathtubs, soffits, or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings.

Dwelling unit entrance doors from interior corridors together with their perimeter seals shall have a Sound Transmission Class (STC) rating of not less than 30 and such perimeter seals shall be maintained in good operating condition.

3. Impact Sound Insulation--all separating floor/ceiling assemblies between units or guest rooms shall provide impact sound insulation equal to that required to meet an Impact Insulation Class (IIC) of 50 (45, if field tested) as defined in UBC Standard No. 35-2. Floor coverings may be included in the assembly to obtain the required rating, and must be retained as a permanent part of the assembly and may only be replaced by other floor covering that provides the same sound insulation required above.

4. Tested Assemblies--field or laboratory tested wall or floor/ceiling designs having an STC or IIC of 50 or more as determined by UBC Standard 35-1, 35-2 or 35-3 may be used without any additional field testing when in the opinion of the building officials the laboratory tested design has not been compromised by flanking paths. Tests may be required by the building official when evidence of compromised separations is noted.

5. Field Testing--field testing, when required, shall be done under the supervision of a person experienced in the field of acoustical testing and engineering, who shall forward test results to the building official showing that the minimum sound insulation requirements stated above have been met.

6. Airborne Sound Insulation Field Tests--when required, airborne sound insulation shall be determined according to the applicable Field Airborne Sound Transmission Loss Test procedures of UBC Standard No. 35-3. All sound transmitted from the source room to the receiving room shall be considered to be transmitted through the test partition.

At the discretion of the building owner a simplified field test procedure (ASTM E597-77T) may be used as a screening test for the partition(s) in question. To pass the test the normalized sound level difference, D_n , as defined

in the test procedure, shall have a value of 50 or greater. If the partition(s) do not pass this screening test, the building owner has the option of repairing the partition(s) to pass this test or employing the field STC evaluation test procedures of UBC Standard No. 35-3 to determine if the STC is 45 or greater.

7. Impact Sound Insulation Field Test--when required, impact sound insulation shall be determined in accordance with UBC Standard No. 35-2.

NOISE INSULATION FROM EXTERIOR SOURCES

1. Location and Orientation--consistent with land use standards, residential structures located in areas where the average annual CNEL exceeds 60 dB, such as proximity to select system of county roads and city streets (as specified in Section 186.4 of the State of California Streets and Highways Code), railroads, rapid transit lines, airports, or industrial areas shall be designed to prevent the intrusion of exterior noises beyond prescribed levels with all exterior doors and windows in the closed position. Proper design shall include, but shall not be limited to, orientation of the residential structure, setbacks, shielding, and sound insulation of the building itself.

2. Interior Noise Levels--interior community noise equivalent levels (CNEL) with windows closed, attributable to exterior sources shall not exceed an annual CNEL of 45 dB in any habitable room. Design maximum noise levels shall not exceed 50 dBA in bedrooms and 55 dBA in other habitable rooms.

3. Airport Noise Source--residential structures to be located within an annual CNEL contour (as defined in Title 4, Subchapter 6, California Administrative Code) of 60 require an acoustical analysis showing that the

structure has been designed to limit intruding noise to the prescribed allowable levels. CNELs shall be as determined from the Noise Element of the General Plan.

4. Vehicular and Industrial Noise Sources--residential buildings or structures to be located within annual exterior community noise equivalent level contours of 60 dB adjacent to the select system of county roads and city streets (as specified in Section 186.4 of the State of California Streets and Highways Code), freeways, state highways, railroads, rapid transit lines and industrial noise sources shall require an acoustical analysis showing that the proposed building has been designed to limit intruding noise to the allowable interior noise levels prescribed in Section T25-1092(e)(2).

Exception: railroads, where there are no nighttime (10 pm to 7 am) railway operations and where daytime (7 am to 10 pm) railway operations do not exceed four (4) per day.

COMPLIANCE

1. Evidence of compliance shall consist of submittal of an acoustical analysis report, prepared under the supervision of a person experienced in the field of acoustical engineering,¹ with the application for building permit. The report shall show topographical relationship of noise sources and dwelling

1

An experienced acoustical engineer shall have a degree in engineering, architecture, physics or allied technical discipline from an accredited college or university and shall be able to demonstrate a minimum of two years full time experience in the following areas of acoustics: transportation noise prediction, building acoustics including party wall detailing, field measurement of environmental noise and reduction of environmental noise data.

site, identification of noise sources and their characteristics, predicted noise spectra and design maximum noise level at the exterior of the proposed dwelling structure considering present and future land usage, basis for the prediction (measured or obtained from published data), noise attenuation measures to be applied, and an analysis of the noise insulation effectiveness of the proposed construction showing that the prescribed interior noise level requirements are met. If interior allowable noise levels are met by requiring that windows be unopenable or closed, the design for the structure must also specify the means that will be employed to provide ventilation, and cooling if necessary, to provide a habitable interior environment.

2. Field Testing--only when inspection indicates that the construction is not in accordance with the approved design, field testing may be required. Interior noise measurements shall be taken under conditions of typical maximum exterior noise levels within legal limits. A test report showing compliance or noncompliance with prescribed interior allowable levels shall be submitted to the building official.

Where a complaint as to noncompliance with this article requires a field test to resolve the complaint, the complainant shall post a bond or adequate funds in escrow for the cost of said testing. Such costs shall be chargeable to the complainant when such field tests show that compliance with these regulations is in fact present. If such tests show noncompliance, then such testing costs shall be borne by the owner or builder.

APPENDIX B

COMMUNITY NOISE OPINION SURVEY

<u>Noise Source</u>	<u>Serious Problem</u>	<u>Some Problem</u>	<u>Not A Problem</u>
Airplanes	8%	26%	66%
Amplified sounds	10%	16%	74%
Automobiles	44%	21%	35%
Buses (school buses, SamTrans)	22%	21%	57%
Construction	2%	11%	87%
Dogs	16%	24%	60%
Fire department	5%	9%	86%
Garbage collection	7%	27%	66%
Helicopters	6%	26%	68%
Horn honkers	10%	21%	69%
Live music	6%	5%	89%
Motorcycles (and motor bikes)	37%	22%	41%
Police cars	12%	19%	69%
Power tools (leaf blowers, saws, etc.)	17%	16%	67%
Radio/phonographs	5%	12%	83%
Repair shops	2%	1%	97%
Rescue vehicles	11%	11%	78%
Sonic booms	1%	4%	95%
Street repairs	1%	11%	88%

COMMUNITY NOISE OPINION SURVEY Continued

<u>Noise Source</u>	<u>Serious Problem</u>	<u>Some Problem</u>	<u>Not A Problem</u>
Trucks	23%	16%	61%
Ventilating fans	1%	3%	96%
Other:			
U.S. 101	1%	1%	98%
Trains	24%	0%	76%
Flood Park	1%	0%	99%
Street cleaners	2%	0%	98%
Tree trimmers	0%	1%	99%
Loudspeakers (El Camino Real Car Service)	2%	0%	98%
Carwash	1%	0%	99%
SLAC (underground drilling)	1%	0%	99%
Racing cars	0%	1%	99%
Willow Park (summer evening program)	1%	0%	99%
Tennis practice board	1%	0%	99%
Hot tub/pool equipment	1%	0%	99%
Roosters	0%	1%	99%
Birds (blue jays)	0%	1%	99%
Cats	0%	1%	99%

APPENDIX C

SUGGESTED READING

Acoustic Design and Noise Control, (1973), Michael Rettinger, Chemical Publishing Co., Inc., New York.

Concepts in Architectural Acoustics, (1972), M. David Egan, McGraw-Hill Inc., New York.

Effects of Noise on People, (1971), EPA, Washington.

Environmental Acoustics, (1972), Leslie L. Doelle, McGraw-Hill Inc., New York.

Handbook of Noise Measurement, (1972), Arnold P.G. Peterson and Ervin E. Gross, Jr., General Radio Company, Concord, Mass.

Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, (1974), EPA, Washington.

Noise and Vibration Control, (1971), Leo L. Beranek (Ed.), McGraw-Hill Inc., New York.

Noise Pollution, (1973), Donald F. Anthrop, D.C. Heath and Company, Lexington, Mass.

The Audible Landscape: A Manual for Highway Noise and Land Use, (1974), U.S. Department of Transportation, Federal Highway Administration, Washington.

The Effects of Noise on Man, (1970), Karl D. Kryter Academic Press, Inc. New York.



C101746954